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Role of Peak Expiratory Flow Meter in Asthma Self-Management

Ravindran Chetambath¹, Gayathri Karedath¹

¹Senior Consultant & Chief of Medical Services, ²Specialist in Pulmonary Medicine

Department of Pulmonology Baby Memorial Hospital, Kozhikode.

Address for Correspondence: Dr. C Ravindran MBBS, MD, DTCD, FRCP, Senior Consultant & Chief of Medical Services, Baby Memorial Hospital, Kozhikode, Kerala, India. Email: crcalicut@gmail.com

Introduction

PEFR is the maximum flow rate generated during a forceful expiration after a full inspiration, and it is expressed in litres/minute. PEFR primarily reflects large airway flow. It is dependent on the lung recoil, airway calibre, effort, and muscular strength of the patient. Maximal airflow occurs during the effort-dependent portion of the expiratory manoeuvre; thus, a low PEFR at many times could be due to poor effort rather than airway obstruction. FEV₁, a dynamic measure of flow used in formal spirometry, is a better indicator of airway obstruction than PEFR. PEFR usually correlates well with FEV₁; this correlation decreases in patients with asthma as airflow diminishes. Even though PEFR and FEV₁ have a good correlation, this may be lost once the airflow decreases. Unlike FEV₁, which is a volume-based parameter, PEFR is a flow-based measurement and does not reflect peripheral airway involvement. Hence, it is more suitable as a monitoring tool than a diagnostic one. Nonetheless, it is a simple, easy-to-perform PFT that is particularly valuable in the diagnosis and monitoring of obstructive airway disease, especially asthma.

Indications

- * Self-assessment and self-management of asthma symptoms based on a written action plan
- * Assessing severity and the response to treatment during acute asthma exacerbations in adults and adolescents
- * Home monitoring of asthma
- * Assessing occupational asthma [1]
- * Monitoring effects of ozone and other air pollutants on respiratory function [2]
- * Monitoring of chronic obstructive pulmonary disease (COPD) [3]

Contraindications

No absolute contraindications. But relative contraindications include the following:

- * Facial paralysis
- * Facial burn
- * Unable to hold firmly the mouthpiece due to paresis or weakness

Measurement Technique

PEFR is measured using a handheld mechanical peak flow meter. A proper technique should be ensured to get reliable results.

1. The procedure should be performed in a standing position or sitting up straight, and the peak flow meter should be held horizontally.
2. Move the indicator in the flow meter to 0.
3. Take in a deep breath
4. Place the meter in the mouth and close the lips around the mouthpiece. Ensure a tight seal and see that the tongue is not blocking or inside the opening.
5. Blow out as hard and fast as possible, using the chest and abdominal muscles. This should take no more than 2 seconds.
6. Write down the result.
7. Repeat the steps above 2 more times.
8. The highest of the 3 readings is to be recorded.

During the OP visit physician should teach proper technique to the patient [4]. Clinicians should also review the technique at subsequent follow-up visits. Peak flow rates in individual patients tend to decrease over time, likely from waning skill and effort [5]. This observation highlights the need for ongoing retraining of techniques after the initial clinic visit. Devices must be regularly calibrated, and disposable mouthpieces should be used to prevent cross-infection.

Reference Values and Personal Best

PEFR varies with age, sex, height, and ethnicity. A "personal best" value, which is the highest PEFR recorded during a period of good control, is often more useful for individual comparison [5]. And this should be equal to or more than 80% of the predicted value of the patient. During a monitoring period of 2 to 3 weeks, the patient should record PEF measurements at least twice a day. On both occasions, the patient should measure the PEF at least three times and note the highest value. A diurnal variation is normal, with lower readings in the morning and higher values in the evening. A value of less than 10% is normal. In mild asthma, the value is between 10 and 20%. In asthma patients, a diurnal variation >20% is indicative of poor control [6].

$$\text{PEF variability (In percentage)} = \frac{\text{Highest PEF Reading} - \text{Lowest PEF Reading} \times 100}{\text{Highest PEF Reading}}$$

Interpretation of PEFR

To guide patients in home monitoring, particularly those with asthma, PEFR is often interpreted using a color-coded zone system: peak flow meters come equipped with gauge markers indicating 3 "zones" that can be set by the patient or clinician to help users interpret their peak flow values.

Green Zone: Reading in the green zone signifies 80 -100% of personal best. This zone suggests that asthma is well controlled, and one should continue this strategy.

Yellow Zone: PEFR values between 50-80% are in the yellow zone. Patients with their PEFR in this zone should be cautious. They could detect early exacerbation and therefore adjust daily activities and the dose of the drugs.

Red zone: PEFR values below 50% of the personal best signify severe airway obstruction and suggest immediate medical attention.

Clinical Applications

PEFR is most useful in monitoring asthma control. It helps in identifying early exacerbations and assessing the efficacy of therapy. In the emergency departments, it supports triage decisions and assesses the response to bronchodilators. Used as part of asthma action plans for individualized therapy adjustments. Unlike FEV₁, PEFR does not correlate well with COPD severity, limiting its standalone utility. Serial measurements of PEFR can help link symptom patterns with specific occupational or environmental exposures, e.g., in reactive airways dysfunction syndrome (RADS).

Advantages

- * Low-cost and portable
- * Allows for frequent monitoring, even in-home settings
- * Easy to teach and perform
- * Encourages patient engagement and self-management in asthma

Conclusion

A peak flow meter is a handy portable device that can be used to measure the airflow in obstructive airway diseases. Daily fluctuation in symptoms, especially in asthma, can be monitored by the patients, and an appropriate decision on further treatment can be taken. This helps in identifying early warning signs of asthma and adjusting management to prevent further deterioration. This helps the patient to avoid frequent physician visits or emergency room visits due to exacerbations.

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